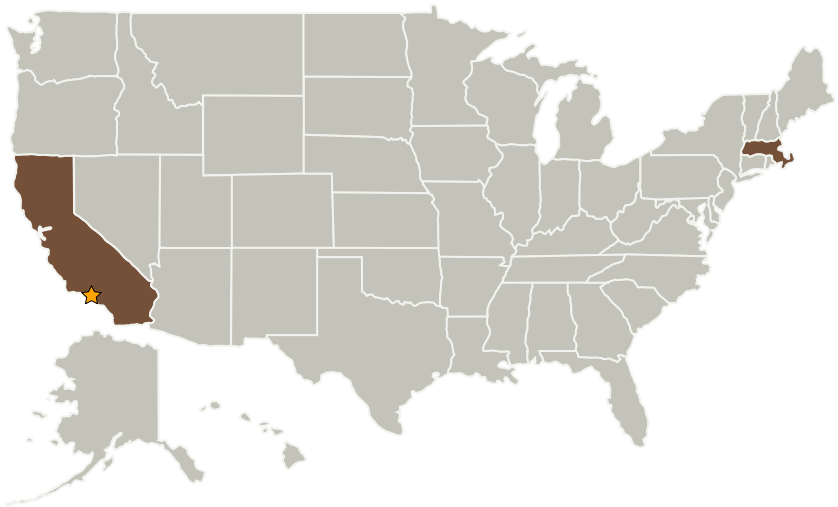
High Resolution Silicon Deformable Mirrors, Phase I

Completed Technology Project (2004 - 2005)

Project Introduction

This proposal describes a plan to build a prototype small stroke, high precision deformable mirror suitable for space-based operation in systems for high-resolution imaging. The prototype DM will be fabricated through a novel combination of micromachining and wafer bonding steps, and will rely on single crystal silicon for all structural components, promising unprecedented thermal stability and optical quality. These DMs will have a 65 mm aperture diameter, 4096 of degrees of freedom, 1?m of stroke, and a highly reflective mirror surface that can be adjusted repeatably to within 1nm RMS over the controllable range of spatial frequencies. The device will address all fundamental requirements for DMs to be used in space-based applications, by combining the best features of conventional discretely-assembled macroscale DMs (e.g. large aperture, good optical quality, and high reliability) with the best features of integrated microelectromechanical system (MEMS) DMs fabricated using semiconductor processing techniques (e.g. nanometer-scale repeatability, scalability to >104 actuators, and compactness). By using the full area of a silicon wafer for each mirror, these MEMS DMs will be significantly larger than any previously-reported MEMS DM. The device architecture will parallel that of the highly successful commercial MEMS DMs that were pioneered by Boston Micromachines Corporation.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
Boston Micromachines Corporation	Supporting Organization	Industry	Cambridge, Massachusetts

Primary U.S. Work Locations	
California	Massachusetts

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Paul Bierden

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.2 Observatories
    - TX08.2.1 Mirror Systems